COMPARISON OF ORGANIZATIONAL SAFETY CULTURES AT TWO AVIATION ORGANIZATIONS

Terrence Kelly & Manoj S. Patankar, Ph.D.
Saint Louis University
St. Louis, Missouri

An important aspect of providing an overall safe environment is the safety culture that exists within a given organization. In order to measure the differences in safety cultures at two aviation organizations, a 50-item questionnaire was distributed to three professional groups, flight operations, maintenance, and other employees, within two partner organizations. The responses from each profession group were compared across the two organizations. The results of this study indicate that although there are some similarities between the two organizations, these companies have significantly different safety cultures. These differences may be attributable, at least partially, to the differences in age and experience of the pilots and mechanics at these two companies. A comparative assessment of organizational safety cultures is valuable in developing appropriate intervention strategies and subsequently measuring their effectiveness.

Introduction

Aviation organizations typically operate in a heavily regulated environment (Dreikorn, 1995). A key element of regulation is to ensure that the organization operates in a way that minimizes hazardous conditions and precludes or attempts to preclude the inadvertent hazard from materializing into an incident or accident. While the safety of the flying public is a generally acknowledged priority, the organization must similarly be concerned with the safety of employees, the protection of capital assets and the safeguard of the surrounding environment.

As business entities, most aviation organizations exist to generate revenue and ideally earn a profit. Advances in safety are incremental in nature and in many cases are expenses that must be absorbed by the users of the aviation organization. Lynch (2002) quotes David Hall a deputy regional manager for the United Kingdom's Civil Aviation Authority (CAA) who admits, "While most companies say safety is our number one priority, in reality production is seen as the first concern." In order to maintain an aviation infrastructure that is economically viable it becomes a business imperative that the costs associated with safe operations be managed prudently.

While the cost of safety may be difficult to itemize, it nevertheless reflects on the profitability, economic health and bottom-line of the organization. One arguably cost effective method of enhancing the overall safety of the organization is the initiation and stewardship of a strong safety culture. In a study conducted by Gaba, Singer, Bowen, & Ciavarelli (2003) measuring the differences in safety climate between hospital personnel and naval aviators the investigation "determined that a key element of high reliability is a 'culture of safety' permeating the organization."

One strength of a strong safety culture, when exercised correctly, is that the drive to identify with those organizational characteristics that lead to safe operation becomes second nature and a normal part of conducting everyday operations. As opposed to being reactionary in nature the culture influences the effort and attitudes of the organization on a daily basis, influencing decision making in the individual as well as the group. The culture may be described as the rational behind performing certain task or making certain policy and implementation decisions as opposed to actually performing the task and making the decisions. While the nature of organizational culture is somewhat stable as compared to organizational climate, the culture should also be able to evolve as the organization and its constituency evolves.

In this study, we present a comparison of two aviation organizations in terms of their extant organizational safety cultures. A survey questionnaire was used to solicit responses to 50 items on a Likert-type scale. These 50 items were then analyzed in terms of ten scales identified by Patankar (In press). The scales used by Patankar are consistent with those used by other researchers in studying safety cultures in aviation as well as other industries (cf. Helmreich & Merritt, 1998; Taylor & Thomas 2003; and Ciavarelli & Figlock, 1997).

Literature Review

Describing a safety culture becomes a somewhat qualitative synthesis of group characteristics and attributes. The IOMA (2003b) quotes the United Kingdom's Health & Safety Executive stating that a safety culture is "The product of individual and group values, attitudes, competencies, and patterns of behavior that determine the commitment to and the style and proficiency of an organization's safety and health programs. Gaba et al. (2003) support this definition adding that "a culture is presumed to depend largely on shared values and norms of behavior articulated by senior management and translated with high uniformity into effective work practices at the front line."

The safety culture in any organization may be seen as a loop type system. That is to say that safety concerns and strategies should be promoted from top management as well as those individuals working on

the floor. The lines of communication should flow in both directions in order to comprehensively empower each individual within the organization to act as a mechanism within the safety evaluation and management process. The prevailing safety culture within an organization, however, is strongly dependent upon each individual in that organization. According to Wells (2003) "safety has to be delegated to every individual in the facility." Thus, it cannot be categorized as the responsibility of a limited number of individuals or that of a specific group such as the quality assurance department, instructor pilots, check airmen, shop stewards, etc.

The individual's contribution to the safety culture is largely based on their understanding of the necessity and effectiveness of the prevailing safety efforts. An individual that understands the rationale behind a given strategy is better able to tactically implement those elements of strategic safety programs and processes. Taylor (1995) has measured such individual's sense of the connection with organizational safety priorities in terms of "goal sharing."

The importance of a positive safety culture includes the reality that culture is a viable form of predicting performance. "Culture can be measured and managed" (Eckenfelder, 2003); therefore, culture may be manipulated to meet the needs of a dynamic organization and industry. Eckenfelder (2003) further states, "organizational attitudes will determine whether a safety initiative will be successful." An organization with a positive safety culture is likely to reap the benefits of improved safety including passenger safety, worker safety, asset and environmental safety.

Key Elements of Safety Culture

IOMA (2003b) quotes Dr. Thomas Krause, in identifying the following three categories that contribute to an overall positive safety culture.

1. Organizational Factors. A commitment to developing and maintaining a positive safety culture begins with management. The effectiveness of the safety culture is dependent on the perception of employees with regard to the commitment and willingness of management to make and implement decisions that reflect and acknowledge employees as being vital to the organization. The creditability and trust of management as perceived by the workforce is vital for the overall morale and commitment of the workforce to sincerely interact within the safety process.

2. Team Factors. An element necessary for the promotion of a strong safety culture is the ability of differing workgroups to work together effectively. Aviation organizations are somewhat unique with regard to the wide cross section in the socioeconomic and educational background of its employees.

Additionally a contrast exists between the levels and degrees of responsibilities from workgroup to workgroup. A binding element influencing the ability of workgroups to interact effectively includes the level of professionalism of the individual or group, as perceived by their coworkers.

3. Safety Performance Factors. In order for a safety culture to thrive the organization must set as a real priority a commitment to safe operations. In addition to resources this commitment will include an inclusive communication strategy that allows and encourages the employees to intervene without the risk of repercussions, and the ability to go through the chain of command to communicate unsafe conditions and practices to management at all levels.

Measurement of Safety Culture

Differences in organizational cultures have been measured in terms of factors such as safety compliance, hazard communication practices, and employee-management trust (Ciavarelli & Figlock, 1997; and Taylor, 1995). Organizations with more positive safety cultures tend to have better communication among their employees, higher levels of assertiveness, and higher levels of employee-management trust. A positive safety culture is a collective mindset that is typically measured in terms of individual attitudes and specific artifacts such as organizational policies and procedures.

Patankar (In Press) developed an Organizational Safety Culture Questionnaire (OSCQ) using some items from the Cockpit Management Attitudes Questionnaire (Helmreich, Foushee, Benson, & Roussini, 1986), Maintenance Resource Management/Technical Operations Questionnaire (Taylor, 1995), and Command Safety Assessment Questionnaire (Ciavarelli & Figlock, 1997) and some new items to specifically compare attitudes across three professional groups: pilots, maintenance personnel, and other employees such as dispatchers, ramp agents, baggage handlers, etc.

Methodology

The intent of this study was to compare the organizational safety cultures across two aviation organizations.

Instrument

The Organization Safety Culture Questionnaire (OSCQ) (Patankar, In Press) was used as the instrument in the assessment of safety culture at each organization. The OSCQ was developed and compiled to measure safety cultures across three distinct employee groups at each organization and serves as a hybrid instrument utilizing some questions from a number of existing instruments as well as some that were newly developed.

Elements of the Cockpit Management Attitudes Questionnaire developed by Helmreich and Merritt (1998) were included in OSCQ to assist in measuring attitudes and opinions of pilots. The Maintenance Resource Management/Technical Operations Questionnaire developed by Taylor and Thomas (2003) was useful in measuring the degree and level of trust within an organization. The Command Safety Assessment Questionnaire was used to provide information surrounding "many of the measurable components of high-reliability organizations." (Ciavarelli & Figlock, 1997).

The resultant OSCQ consisted of a 50-item questionnaire that measured responses on a five-point Likert-type scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree). A factor analysis was conducted across the items in the Organizational Safety Culture Questionnaire. As a result of such analysis, eight scales emerged: pride in company, professionalism, safety opinions, supervisor trust and safety, effects of my stress, need to speak-up, safety compliance, and hazard communication (Patankar, In Press). These scales are consistent with those reported by Taylor (1995), Ciavarelli and Figlock (1997), and Helmreich et al. (1986).

Results

Description of samples

Data analyzed from "Company A" were previously gathered in a study conducted by Patankar (In Press) and included survey results from flight operations personnel, maintenance personnel and other employees. A total of 399 surveys were returned from the three employee groups. The sample size for corresponding population in this study was reported to be statistically sufficient.

For the present study, responses to the OSCQ were collected from "Company B" and a comparative analysis was performed. At the time of this writing, 237 responses were received and included in the analysis. In order for the sample size to be statistically adequate for the population at Company B, 291 responses were required. It is anticipated that by the time this paper is presented at the conference, adequate responses will have been received.

Analysis

The responses from both companies were combined into a comprehensive sample of 639 responses (n=402 for Company A—it includes three responses received since previous analysis and n=237 for Company B). This comprehensive sample was sorted in terms of mechanics, pilots, and other employees. Each such professional group was analyzed to determine whether or not differences in the responses to any of the eight pre-established scales were statistically significant.

Mechanics. An independent-sample *t*-test was conducted to measure differences in attitudes and opinions of mechanics from "Company A" and "Company B." Statistically significant differences were found between the responses on the following scales: Pride in Company ($p <0.008$), Coworker Personnel Trust ($p<0.033$), and Safety Compliance ($p <0.024$). Figure 1 illustrates these differences.

With the exception of "Effects of my Stress," the mechanics at "Company A," as a group consistently evaluated items critical to a positive safety culture higher then their counterparts in "Company B." Therefore, another independent-sample *t*-test was performed to test for significant differences in any of the demographic characteristics between the two companies that may have contributed to the differences in their safety attitudes and opinions. Statistically significance differences were found between the age of the average mechanic ($p<0.000$) and the amount of maintenance experience ($p<0.001$). The mechanics at Company A were significantly older (mean age = 42 years) than those at Company B (mean age = 35 years). The mechanics at Company A were significantly more experienced (mean experience = 19 years) than those at Company B (mean experience = 13 years).
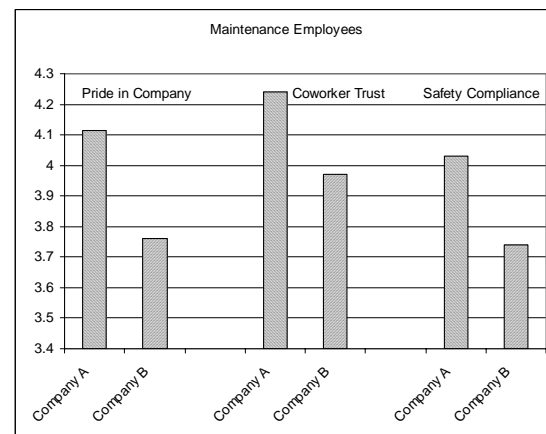

Figure 1: Significant differences among mechanics

The higher scores on "Effects of My Stress" on the part of Company B mechanics seem to indicate that they were more aware of how stress could affect their performance.

Pilots. An independent-sample *t*-test was conducted to measure differences in attitudes and opinions of pilots from "Company A" and "Company B." Statistically significant differences were found between the pilots at "Company A" and "Company B" on the following scales: Supervisor Trust & Safety ($p<0.024$), Pride in Company ($p<0.004$), Professionalism ($p<0.003$) and Effects of My Stress ($p<0.016$). Figure 2 illustrates these differences.

Like the mechanics, with the exception of "Effects of my Stress," pilots at "Company A," as a group consistently evaluated items critical to a positive safety culture higher than their counterparts in "Company B." Consistency is also observed in that the pilots at "Company A" are generally older and have more experience then the pilots at "Company B." Therefore, another independent-sample t-test was performed to test for significant differences in any of the demographic characteristics between the two companies that may have contributed to the differences in their safety attitudes and opinions. Statistically significant differences were found between the demographics in the following areas: Years of Experience ($p<0.000$), Years as a Pilot ($p<0.000$), Past Experience ($p<0.003$), Civilian Experience ($p<0.026$), Age ($p<0.000$) and Other Airline Employment ($p<0.000$). Company A pilots were significantly older (mean age = 45 years versus 35 years) and more experienced than Company B pilots (29 years versus 17 years in total experience).
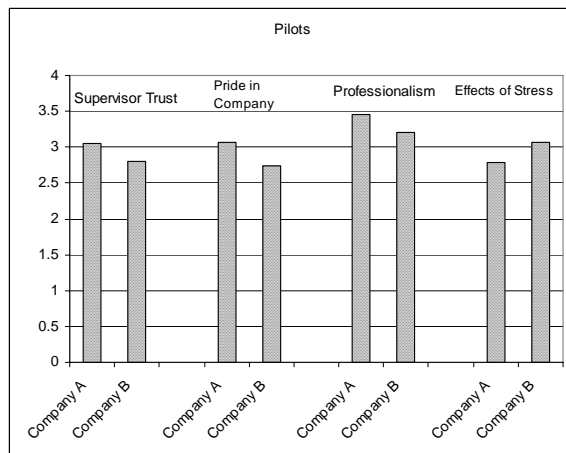

Figure 2: Significant differences among pilots

Other Employees. An independent-sample t-test was conducted to measure differences in attitudes and opinions of "other employees" from "Company A" and "Company B." Statistically significant differences were found between other employees at "Company A" and "Company B" in the following areas: Supervisor Trust & Safety ($p<0.014$), Professionalism ($p<0.007$), Safety Opinions ($p<0.001$), Effects of My Stress ($p<0.001$) and Hazard Communication ($p<0.000$). Figure 3 illustrates these differences.

Unlike the mechanics and pilots, the "Other Employee" group at Company B evaluated a majority of those items identified as contributing to a positive safety culture higher than their counterparts at Company A.

Since the previous tests on demographics of pilots and mechanics were successful in identifying the differences in the age and experience levels of the two groups, a similar independent-sample t-test was conducted to test for differences within the "Other Employees" group. No statistically significant differences were found between the demographics regarding the "Other Employees" of Company A and Company B.
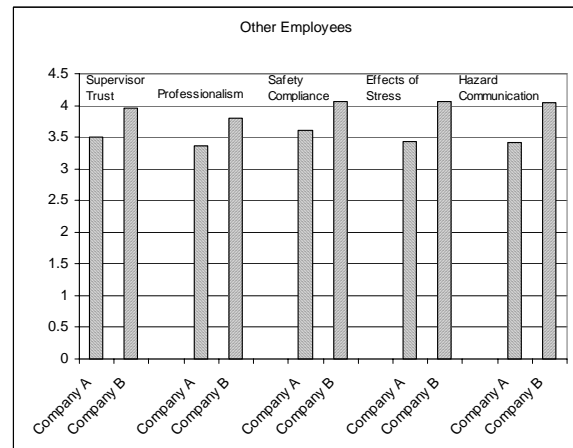

Figure 3: Significant differences among other employees

Perceptions about professionalism. Whether or not pilots and mechanics perceive themselves to be practicing high standards of professionalism could be judged by their responses to Item 16 and Item 6, respectively. Item 16 states, "Our pilots perform high standards of professionalism" and Item 6 states, "Our mechanics practice the highest maintenance standards." Responses to these items are presented in Figures 4.
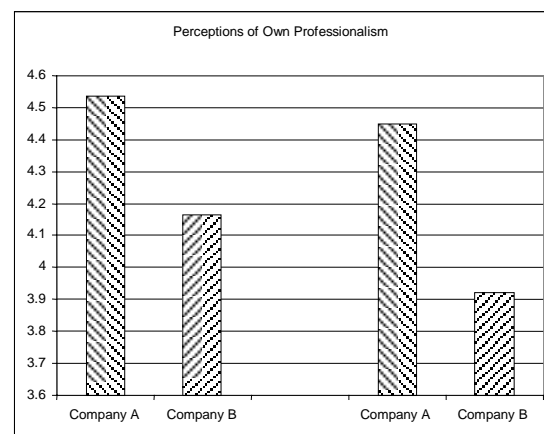

Figure 4: Pilots' and mechanics responses to perceptions of own professionalism

As is evident from Figure 4, both pilots ($p<0.000$) as well as mechanics ($p<0.001$) from Company A

consider themselves to be practicing high standards of professionalism

Discussion

In evaluating the overall safety culture of the two aviation organizations it becomes clear that both pilots as well as mechanics at "Company A" demonstrated a significantly higher opinion with regard to specific areas contributing to the safety culture within their respective organizations.

In analysis of demographic data for maintenance employees it was determined that the average age, years of service to the aviation organization and total aviation experience for those employees of "Company A" was significantly higher then their counterparts in "Company B."

Likewise flight employees at "Company A" generally possessed twice the number of years of experience and on average were more then ten years older then the flight employees at "Company B." When analyzing the demographic data surrounding flight employees "Company A" demonstrated significance in six out eight evaluated categories.

In contrast to the maintenance and flight employee groups the other employee group for "Company B" demonstrated significantly higher opinions with regarded to variables surrounding "Company B's" safety culture. Interestingly, there were no significant differences in the demographic analysis between "Company A" and "Company B" other employee groups.

The following hypotheses are presented as a result of this research:

Mechanics from Company B seem to be more aware of stress effects. Therefore, they either feel more stress in their job, are not able to manage their stress levels as well, have received some stress-management training, or a combination of the above.

The more positive safety culture at Company A is attributable, at least partially, to the older, more experienced pilots and mechanics.

Other employees in both companies have generally similar opinions about safety. Consequently, the safety culture of an aviation organization is most influenced by pilots and mechanics.

Conclusions

Professional groups such as pilots and mechanics from different aviation organizations have somewhat different attitudes and opinions regarding safety. Such differences, as demonstrated in this study, are most likely to be due to differences in organizational cultures rather than differences in national cultures or professional cultures. Age and level of experience seem to have a measurable effect on the safety attitudes and opinions—older and more experienced individuals tend to have more positive scores. Finally, safety culture in an aviation organization seems to be most influenced by pilots and mechanics rather than dispatchers, ramp agents, baggage handlers, etc.

A longitudinal study at both the organizations presented in this study as well as other aviation organizations will be very useful in understanding overall safety cultures within aviation organizations and in developing appropriate intervention strategies and subsequently measuring their effectiveness.

References

Ciavarelli, A., & Figlock, R. (1997). Organizational factors in Naval Aviation accidents. *Assessing Organizational Accident Risk*. The Center for Risk Mitigation Conference, University of California, Berkeley.

Dreikorn, M. (1995). *Aviation industry quality systems: ISO 9000 and the Federal Aviation Regulations*. Milwaukee, Wisconsin: ASQC Quality Press.

Eckenfelder, D. (2003). Getting the Safety Culture Right. *Occupational Hazards* 65, 10. ABI-INFROM Global p. 32.

Gaba, D., Singer, S., Bowen, J., & Ciavarelli, A. (2003). Differences in Safety Climate between Hospital Personnel and Naval Aviators. *Journal of Human Factors 45*(2).

Helmreich, R., & Merritt, A. (1998). Culture at work in aviation and medicine: National, organizational and professional Influences. Aldershot, U.K.: Ashgate Publishing Ltd.

IOMA (2003a). These safety tricks from the pros will save time & money. *Safety Director's Report* p. 2.

IOMA (2003b). Are you focusing enough on your safety culture? *Safety Director's Report* p. 1.

Lynch, K. (2002). Changing the economics of human factors in maintenance: An NTSB symposium takes a closer look at why human factors initiatives haven't made more progress. *Business & Commercial Aviation 91*(4), p. 68.

Patankar, M. (In Press). A study of safety culture at an Aviation. *Journal of Applied Aviation Studies*.

Taylor, J. (1995). Effects of Communication & Participation in Aviation Maintenance. In Proceedings of the Eighth International Symposium on Aviation Psychology. Columbus, Ohio, The Ohio State University, pp. 472-477.

Taylor, J., Thomas, R. (2003) Toward Measuring Safety Culture in Aviation Maintenance: The Structure of Trust and Professionalism. *The International Journal of Aviation Psychology, 13*(4), 321–343.

Wells J. (2003). How effective is your safety culture: Those who are succeeding today recognized yesterday that people are the key. *Occupational Health & Safety*, 72(9), p. 26.